

Automated Medicine Dispenser and Reminder IoT System for Elderly Care

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ABSTRACT

The administration of medicines at the correct time is essential for effective treatment and patient recovery. Over the years, medication management has evolved from manual schedules and written prescriptions to electronic reminder systems aimed at improving adherence. However, many patients, particularly elderly individuals and those with chronic illnesses, still face difficulties in remembering complex medication routines, leading to missed doses, incorrect intake, and reduced treatment effectiveness. Traditional medication management methods primarily rely on manual supervision, alarm clocks, or basic reminder applications, which often lack automation, real-time monitoring, and remote notification capabilities. These limitations create a need for a more intelligent and reliable solution that can ensure timely medicine administration while reducing human dependency. To address these challenges, this study presents an IoT-enabled automated medication management system that integrates a microcontroller, Real-Time Clock (RTC), Wi-Fi communication module, LCD display, buzzer, and motor-driven dispensing units. The system continuously monitors predefined medication schedules and automatically generates reminders when the scheduled time is reached. Simultaneously, it dispenses the appropriate medicine and transmits notifications to remote users or caregivers through wireless communication channels. The integration of automation and IoT technology enhances medication adherence, minimizes dosing errors, and supports continuous patient monitoring. The proposed approach offers a cost-effective, user-friendly, and dependable healthcare solution suitable for home-based and assisted-care environments. Its implementation contributes significantly to improving patient safety, treatment compliance, and overall healthcare management through intelligent and timely medication administration.

Keywords: IoT, Automated Medication Management, Smart Medicine Dispenser, RTC, Medication Adherence, Remote Patient Monitoring

1. INTRODUCTION

Currently, worldwide aging and regularity of persistent diseases are flattering a broad concern. Numerous countries are undergoing hospital restructuring by reducing the number of hospital beds and escalating home healthcare, which is envisioned to perk up health care quality, has fascinated wide-ranging attention. In order to track the physical status of the elderly and, in the meanwhile, to keep them healthy, the proposed idea will be helpful. IoT expands the Internet into our everyday lives by wirelessly connecting various smart objects, and will bring significant changes in the way we live and interact with smart devices. Internet of Things (IoT) is a network where many of the objects that surround us will be networked in one form or another. In this process of encryption, the schedule data or doctor's prescription are sent to pill box through mobile app. The LEDs are placed for indication and buzzer for alarm alerts and reset button is used to count for medicine in cloud platform. During the past century the life expectancy of the living world has increased by more than 50 percent due to advancements in medicine. Utilizing the groundbreaking telemedicine technology, the Pill Ejector has been designed in such a way that it can help the elderly patients to take their medicines on time without any external help. It is an automatic medication dispenser that removes the stress and danger of missing or incorrect doses of medicine. Thus, the machine helps them to live an independent life with reliable functionality. There have been alarming results showing the fatal effects of medication error. The main aim of E-Pill Ejector is to reduce the medication errors and the fatal effects of it. Once the device is loaded with pills and the time schedule is set, it reminds the patient to take

the right medicine on time. The Digitalized Voice Activated E-Pill Ejector is designed using telemedicine technology and it removes the stress and danger of missing or incorrectly administering medicine doses. The main step in the treatment of any disease is not just prescribing medication but also for the right administration of the drugs. Thus, this machine automatically gives the right pills at the right time and also sounds an alarm to remind the patient about the medication time. Once voice feedback is received from the patient, the pills are ejected. The proposed model makes it easy especially for the elderly people who has one or more chronic condition or those who have to take multiple medications. This device mainly assists people with chronic device or those suffering from heart diseases, osteoporosis, diabetes or cancer.

2. LITERATURE SURVEY

Sriskanthan and Tan [1] proposed a Bluetooth-based medication management system that assists patients in maintaining medication schedules through wireless communication technologies. The system demonstrated the feasibility of integrating healthcare monitoring with automated reminder mechanisms to improve medication adherence. Viral Shah et al. [2] developed a Smart Medicine Box capable of reminding patients about medication timings using embedded electronics. The proposed system generated alerts and notifications to ensure timely medicine consumption, thereby reducing the chances of missed doses. Naga Udayini Nyapathi et al. [3] introduced a Smart Medicine Box using an ARM7 microcontroller. The system maintained medicine schedules and provided reminders through automated alerts, enabling patients to follow prescriptions accurately and efficiently. Aakash Sunil Salgia, Ganesan, and Raghunath [4] proposed a Smart Pill Box that monitored medication schedules and generated alerts at predefined intervals. Their work focused on improving medication compliance among elderly and chronically ill patients through intelligent reminder functionality.

Raga Lavima and Subhramanya Sarma [5] developed an IoT-based Intelligent Medicine Box capable of transmitting medication-related information through Internet connectivity. The system enabled remote monitoring and improved communication between patients and caregivers. Suneetha Uppala and Rama Murthy [6] proposed a Smart Medicine Time Indication Box that provided timely alerts using embedded hardware components. The system enhanced medication management by ensuring patients received reminders at scheduled intervals. Ilkko et al. [7] introduced UbiPILL, a medicine dose controller designed for ubiquitous home environments. The system integrated home automation and wireless sensor technologies to monitor medicine box activity remotely through a web-based interface, thereby supporting elderly care and medication adherence.

Kliem et al. [8] proposed a secure communication architecture for mobility-aware eHealth environments. The study focused on ensuring secure transmission of medical information among patients, healthcare providers, ambulances, and hospitals while maintaining privacy and authentication requirements. Parida et al. [9] developed an RFID-based in-house drug management system that utilized RFID tags, readers, cameras, and web technologies to track medicine usage and patient activities. The system was particularly beneficial for elderly and less educated users requiring medication assistance. Clifton et al. [10] presented a large-scale clinical validation of an integrated patient monitoring system. The study demonstrated the effectiveness of machine learning techniques in processing healthcare data and improving clinical decision-making through continuous monitoring.

Hamida et al. [11] proposed a secure in-home wearable monitoring and diagnosis system for healthcare applications. Their work evaluated communication and security protocols suitable for remote health monitoring and highlighted efficient approaches for patient data protection. Ray et al. [12] introduced the Home Health Hub Internet of Things (H3IoT) framework that integrated multiple healthcare devices through IoT technologies. The proposed architecture addressed interoperability challenges and enabled

efficient health monitoring through connected devices. Shivakumar et al. [13] designed a wireless sensor network-based vital sign monitoring system integrated with telemedicine technologies. Patient data collected through sensors was transmitted to cloud platforms, allowing healthcare professionals to monitor patients remotely and respond during emergencies.

Ajmal Sawand et al. [14] proposed a multidisciplinary eHealth monitoring framework combining Bluetooth, Wireless Body Area Networks (WBAN), and cloud computing technologies. The system facilitated efficient collection, transmission, and analysis of medical data while addressing challenges related to reliability and patient-centric healthcare. Huang et al. [15] designed and implemented an Intelligent Pill Box aimed at improving medication safety among elderly individuals. The system provided automated reminders and monitoring functions to reduce medication misuse and improve adherence to prescribed treatments.

The authors in [16] presented a medication compliance application designed to simplify medicine management for users unfamiliar with advanced mobile technologies. The application passively collected adherence data and provided healthcare researchers with valuable information for analyzing patient medication behavior. The authors in [17] developed a user-friendly mobile medication reminder application capable of processing multiple prescriptions and generating both visual and audio alerts in different languages. The system significantly improved medication adherence, particularly among elderly patients requiring regular medical supervision.

3. PROPOSED SYSTEM

The proposed methodology establishes a systematic approach for developing an intelligent medication management and automated drug dispensing system capable of assisting patients in adhering to prescribed treatment schedules. The framework integrates real-time monitoring, embedded control, wireless communication, and automated dispensing mechanisms to provide accurate and timely medication administration. By combining a RTC, microcontroller-based control unit, IoT communication module, alert generation subsystem, and motor-driven medicine dispensers, the system ensures reliable operation while minimizing human intervention, as shown in figure 1. The methodology focuses on improving medication adherence, reducing missed doses, and enhancing patient safety through automation and remote monitoring capabilities.

User Interface / Remote Monitoring Device

- Caregivers, family members, or healthcare providers interact with the system through connected monitoring devices.
- Medicine schedules, reminder notifications, and administration status can be viewed remotely.
- User commands and schedule configurations are transmitted to the control unit through wireless communication channels.
- Notifications regarding medication events are received in real time.

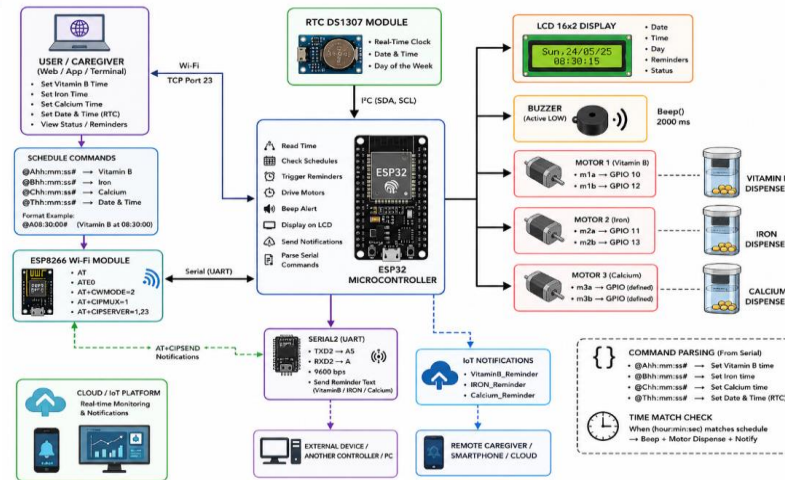


Figure 1: Proposed system Architecture

Microcontroller Control Unit

- The microcontroller acts as the central processing component of the system.
- It manages scheduling operations, hardware control, communication functions, and medicine dispensing activities.
- It continuously compares stored medication schedules with the current time obtained from the RTC module.
- The controller coordinates all peripheral devices and executes reminder and dispensing operations whenever a scheduled event occurs.

Real-Time Clock (RTC) Module

- The RTC module maintains accurate date and time information.
- It provides continuous timestamp updates to the control unit.
- Medication schedules are verified against RTC values to ensure precise dispensing.
- The RTC maintains timekeeping even during temporary power interruptions.

Medicine Schedule Configuration Module

- This module receives medication schedules from external devices or healthcare personnel.
- Individual schedules can be configured for multiple medicines.
- Each medicine is assigned a specific dispensing time.
- Configured schedules are stored and used for subsequent reminder and dispensing operations.

Alert and Notification Module

- When a medication schedule matches the current RTC time, the alert subsystem is activated.
- Audible alerts are generated using a buzzer to notify the patient.
- Visual reminders are displayed on the LCD screen.
- Notification messages are transmitted to connected devices through the IoT communication module.

LCD Display Unit

- The LCD continuously displays current date and time information.
- It provides medicine reminder messages and system status updates.
- Configuration confirmations and operational notifications are presented to the user.
- The display enhances user interaction and system usability.

Automated Medicine Dispensing Mechanism

- Dedicated motor-driven dispensing units are assigned to individual medicines.
- Upon receiving a dispensing command, the corresponding motor rotates and releases the prescribed medicine dose.
- Multiple dispensing channels support administration of different medications at different times.
- The mechanism ensures accurate and timely medicine delivery.

IoT Communication Module

- Wireless communication is established through the Wi-Fi interface.
- Medication reminders and dispensing events are transmitted to remote users.
- Real-time notifications improve caregiver awareness and patient monitoring.
- The communication subsystem enables remote supervision without requiring physical presence.

Medicine Reminder and Dispensing Decision Logic

- The control unit continuously evaluates current RTC values against stored medication schedules.
- If a matching schedule is detected, the corresponding medicine reminder process is initiated.
- Alerts, notifications, and dispensing operations are executed automatically.
- This decision logic ensures timely medication administration and reduces dependency on manual intervention.

Notification and Status Output

- The system generates medication reminder alerts.
- Dispensing status messages are displayed locally and transmitted remotely.
- Medicine administration events are logged through communication channels.
- The generated outputs provide both patient assistance and caregiver monitoring support.

Schedule Update and Reconfiguration

- Medication schedules can be modified whenever treatment requirements change.
- Updated timing information is transmitted to the controller and stored for future operation.
- The RTC can also be synchronized and updated when required.
- This functionality provides flexibility and supports dynamic medication management.

4. RESULTS AND DISCUSSION

The proposed IoT-enabled Automated Medicine Dispenser and Reminder System was successfully designed and tested to evaluate its functionality and reliability. The system accurately monitored the predefined medication schedule using the RTC module and generated timely reminders through the LCD display and buzzer. Upon reaching the scheduled time, the corresponding motor-driven dispensing unit successfully released the prescribed medicine dose without manual intervention. The Wi-Fi communication module effectively transmitted real-time notifications to caregivers, enabling remote monitoring of medication adherence. Experimental observations demonstrated consistent operation, accurate dispensing, and prompt alert generation under different scheduling conditions. The integration of automation and IoT technology significantly reduced the possibility of missed doses and medication errors. Overall, the developed system proved to be a reliable, cost-effective, and user-friendly solution for improving medication management and patient care in home healthcare environments.

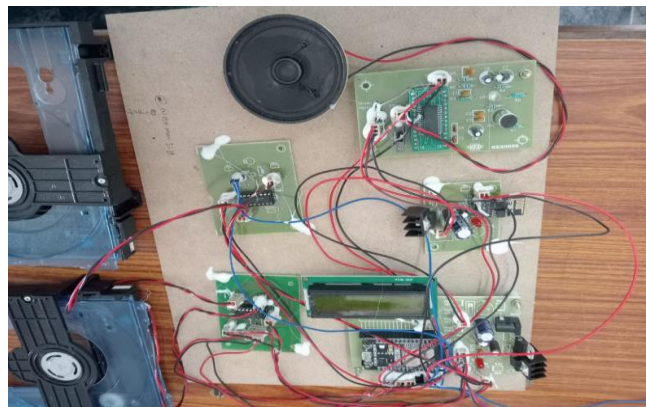


Figure 2: Hardware Prototype of the IoT-Based Automated Medicine Dispenser and Reminder System

The hardware prototype shown in Figure 2 illustrates the complete implementation of the proposed IoT-enabled Automated Medicine Dispenser and Reminder System for elderly care. The setup consists of an ESP8266 Wi-Fi module integrated with a microcontroller-based control circuit, a 16×2 LCD display for showing medication schedules and system status, and a speaker/buzzer unit for generating audible reminder alerts. Two motor-driven dispensing mechanisms are connected to the control board to automatically release medicines at predefined times. The RTC-based scheduling and control circuitry continuously monitor the programmed medication timings and trigger the dispensing operation accordingly. The power supply section ensures stable operation of all electronic modules, while the wireless communication unit enables real-time notification transmission to caregivers or family members. The developed prototype successfully demonstrates automated medicine dispensing, timely alert generation, and remote monitoring capabilities, thereby improving medication adherence and reducing the possibility of missed doses or medication errors in home healthcare environments.



Figure 3: LCD Display Showing Date and Time Information

Figure 3 presents the LCD display module of the proposed IoT-based Automated Medicine Dispenser and Reminder System. The display shows the current date and time obtained from the Real-Time Clock (RTC) module, which serves as the reference for scheduling medication reminders and dispensing operations. The LCD provides real-time system information to the user, ensuring that medication timings are monitored accurately. It acts as a user-friendly interface that keeps patients informed about the system status and upcoming medicine schedules. The clear display of date and time enhances usability, supports timely medication intake, and improves the overall effectiveness and reliability of the medication management system.



Figure 4: Overall Hardware Setup of the IoT-Based Automated Medicine Dispenser

Figure 4 illustrates the complete hardware implementation of the proposed IoT-based Automated Medicine Dispenser and Reminder System. The setup consists of multiple medicine storage compartments connected to motor-driven dispensing mechanisms, a microcontroller control unit, LCD display, speaker/buzzer module, and power supply circuitry. The system uses the RTC module to maintain accurate medication schedules and automatically triggers reminders and dispensing operations at predefined times. The LCD provides real-time system information, while the buzzer generates audible alerts to notify the user about medication intake. Additionally, the integrated Wi-Fi communication module enables remote monitoring and notification services, ensuring effective medication management, improved patient adherence, and enhanced elderly healthcare support.

5. CONCLUSION

The study successfully demonstrates an intelligent IoT-enabled medication management system that automates medicine reminders and dispensing operations. By integrating a real-time clock, microcontroller, Wi-Fi communication module, LCD display, buzzer, and motorized dispensing units, the system ensures that medicines are delivered at the prescribed time with minimal human intervention. The automated reminder mechanism helps reduce missed doses and medication errors, thereby improving treatment adherence and patient safety. Real-time notifications and remote monitoring capabilities enable caregivers to stay informed about medication events and patient compliance. The system provides a cost-effective, reliable, and user-friendly solution for elderly individuals, chronically ill patients, and people with complex medication schedules. Its ability to combine automation, scheduling accuracy, and wireless connectivity makes it suitable for modern healthcare applications. The developed approach enhances healthcare support, promotes timely medication administration, and contributes to improved patient well-being and quality of life.

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